REMARKS

Claims 1-10 and 44-62 are pending.

A. In rejecting claims 44-52 and 62 over Felts et al. (USP 4,888,199) alone or in combination with other references, the Examiner relies on Puchert et al. which discloses fundamentally different deposition mechanism and film, and ignores a significantly more pertinent reference

Claims 44, 45, and 62 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Felts et al. (USP 4,888,199), as demonstrated by M.K. Puchert et al.

Applicants respectfully assert that independent claim 44 and claim 45 depending therefrom, as well as independent claim 62, are novel and patentable over Felts '199 because, for instance, Felts '199 does not teach or suggest adding a flow of an inert gas to the selected deposition gases at a flow rate previously determined to achieve a desired low deposition rate from a plasma enhanced reaction of the selected deposition gases, wherein the desired deposition rate is lower than a deposition rate using the selected deposition gases at the deposition gas flow rates with a lower flow rate of the inert gas.

The Examiner alleges that Felts '199 anticipates the claimed relationship of deposition rates and that "the addition of He increases electron density in the plasma (column 10, lines 47-50) which anticipates the effect of reduced deposition rates considering the fact that these added electrons would effectively shield cations thereby reducing one of the chemical mechanisms of PECVD." Felts '199 is completely devoid of teaching or suggesting this relationship.

Indeed, a prior art reference discloses deposition of a PECVD silicon nitride layer from SiH_4, N_2, and He, in which the deposition rate is positively related to the inert gas flow rate. See D.V. Tsu et al., "Local Atomic Structure in Thin Films of Silicon Nitride and Silicon Diimide Produced by Remote Plasma-Enhanced Chemical-Vapor Deposition," Physical Review B, 7069-76 (May 15, 1986). This reference was cited in the IDS filed on December 27, 1999. This is directly opposite from the claimed invention of depositing a PECVD layer from SiH_4 and N_2O in which the deposition rate

is inversely related to the inert gas flow rate. Tsu et al. discloses the positive correlation of inert gas flow rate (He) and silicon nitride film deposition rate in Tables I and II; page 7071, column 1, lines 1-29; and page 7072, column 1, lines 1-9. "Additional dilution with He serves to increase the deposition rate still further." Page 7071, column 1, lines 13-14. "Increased dilution of the N_2 with He increases the deposition rate by inhibiting recombination and/or deexcitation reactions involving collisions between N atoms and nitrogen molecules." Page 7072, column 1, lines 6-9.

The Examiner, however, completely ignores Tsu et al., which discloses a similar PECVD process for depositing a layer from similar gases having SiH_4, a nitrogen-source gas, and an inert gas. Instead, the Examiner relies on Puchert et al. for allegedly demonstrating the relationship between plasma vapor deposition and He electron density. Puchert, however, discloses a deposition of a fundamentally different material (copper deposition) from a fundamentally different process (a metal plasma beam of a filtered cathodic arc).

Puchert et al. is directed to "the interaction between the metal plasma beam of a filtered cathodic arc and the noble gases helium neon, and argon introduced into the beam path" (page 3493, col. 1, lines 27-30). Puchert et al. discloses a decrease in deposition rate of copper as the pressure and ion current increase. **There is no basis to believe that the results of copper deposition from a metal plasma beam of a filtered cathodic arc can be generalized to plasma-enhanced chemical vapor deposition (PECVD) of a dielectric layer.** The deposition mechanism, deposition apparatus, nature of film deposited are **fundamentally different**. The Examiner's assertions are based on nothing more than speculation.

Therefore, the effect of helium dilution cannot be generalized based on Puchert et al., particularly since the deposition mechanism, the deposition apparatus, and the nature of film deposited are fundamentally different.

Felts '199 discloses the use of the average electron temperature of the plasma T_e to diagnose and control the plasma deposition. "The average electron temperature of the plasma affects the film deposition rate and properties of the resulting

film, so it is an important piece of information to have in a real time plasma control system." Column 2, lines 47-51. There is nothing in Felts '199 that suggests "added electrons would effectively shield cations thereby reducing one of the chemical mechanisms of PECVD," as alleged by the Examiner. Nor does Felts '199 suggest controlling the gas delivery system to add a flow of an inert gas to the selected deposition gases at a flow rate previously determined to achieve a desired low deposition rate from a plasma enhanced reaction of the selected deposition gases, wherein the desired deposition rate is lower than a deposition rate using the selected deposition gases at the deposition gas flow rates with a lower flow rate of the inert gas, as recited in claim 44.

In sum, Puchert et al. does not provide the teaching missing in Felts '199. Tsu et al. teaches away from the claimed invention, suggesting that the claimed invention is novel and nonobvious. Therefore, claims 44, 45, and 62 are novel and patentable over Felts '199.

Dependent claims 46-48 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Felts '199 as applied to claims 44 and 45 above, and further in view of Felts '665. As discussed above, Felts '199 fails to teach or suggest computer instructions for controlling the gas delivery system to add a flow of an inert gas to the selected deposition gases at a flow rate previously determined to achieve a desired low deposition rate from a plasma enhanced reaction of the selected deposition gases, wherein the desired deposition rate is lower than a deposition rate using the selected deposition gases at the deposition gas flow rates with a lower flow rate of the inert gas. Felts '665 does not cure this defect. Accordingly, claims 46-48 are patentable.

Dependent claims 49-52 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Felts '199 as applied to claims 44-48 above, and further in view of Felts '665 and Dory. As discussed above, Felts '665 and Dory fail to cure the defects of Felts '199. Thus, claims 49-52 are patentable.

B. In rejecting claims 1-10, 60, and 61 over Felts et al. (USP 5,365,665) alone or in combination with other references, the Examiner ignores the fact that Felts '665 is completely devoid of any suggestion for controlling the deposition rate of the layer by introducing helium

Claims 1 and 7 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Felts et al. (USP 5,365,665).

Applicants respectfully submit that independent claim 1 and claim 7 depending therefrom are patentable over Felts '665 because, for instance, Felts '665 does not teach or suggest computer readable program code for causing the gas distribution system to introduce a second process gas comprising He into the chamber to control the deposition rate of the first layer.

The Examiner cites Felts '665 at column 5, lines 13-20, 42 for allegedly anticipating this feature of the claim. Felts '665 merely discloses the use of an inert gas (helium or argon) with an organosilicon compound and oxygen of the gas stream to deposit a film. **Nothing in Felts '665 discloses or suggests introducing a process gas comprising He to control the deposition rate of the PECVD deposition layer from the recited process gases.** Thus, claims 1 and 7 are patentable.

Dependent claims 2-6, 9, and 10 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Felts '665 as applied to claim 1, and further in view of Dory (USP 4,877,641). Dory does not cure the defects of Felts '665. Therefore, claims 2-6 and 9 are patentable.

Claims 8, 60, and 61 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Felts et al. '665 in view of Lee (USP 5,286,581). The Examiner cites Lee for merely disclosing that a first reflection from an interface between the photoresist layer and the antireflective layer of an exposure light is an odd number, but it is not at least 3 multiplied by 180° (π in radians) out of phase with a second reflection from an interface between the antireflective layer and the substrate layer of the exposure light. Nothing in Lee teaches or suggests a thickness that is an odd multiple, greater than one,

of the wavelength. Furthermore, Lee does not cure the defects of Felts et al. '665. Accordingly, claims 8, 60, and 61 are patentable.

C. In rejecting claims 53-59 over Felts et al. (USP 5,365,665) in view of Felts et al. (USP 4,888,199) and Dory (USP 4,877,641), the Examiner ignores the fact that the references are completely devoid of any disclosure or suggestion for lowering the deposition rate of the layer by introducing helium

Claims 53-59 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Felts '665 as applied to claim 49 above, and further in view of Felts '199 and Dory.

Independent claim 53 is submitted to be patentable because, for instance, the references do not disclose or suggest that a ratio of the selected flow rate of He to the combined flow rate of SiH_4 and N_2O is at least 6.25:1 to deposit an antireflective layer on the substrate at a deposition rate which is lower than a deposition rate using the same flow rate of SiH_4 and the same flow rate of N_2O with a lower flow rate of He. This feature is completely absent from the cited references.

Independent claim 54 is patentable because, for instance, the references do not teach or suggest computer instructions for controlling the gas delivery system to add a flow of an inert gas to the selected deposition gases at a flow rate previously determined to achieve a desired low deposition rate from a reaction of the selected deposition gases, wherein the desired low deposition rate is lower than a deposition rate using the selected deposition gases at the deposition gas flow rates with a lower flow rate of the inert gas. As discussed above, Felts '199 merely discloses the use of the average electron temperature of the plasma T_e to diagnose and control the plasma deposition. Felts '665 merely discloses the use of an inert gas (helium or argon) with an organosilicon compound and oxygen of the gas stream to deposit a film. Dory does not cure the defects of Felts '199 and Felts' 665. Accordingly, claim 54 is patentable.

Independent claim 55 and claim 56 depending therefrom are patentable because, for instance, the references fail to disclose or suggest means for adding a flow of an inert gas to the selected deposition gases at a flow rate previously determined to

achieve a desired low deposition rate from plasma enhanced reaction of the selected deposition gases, wherein the desired low deposition rate is lower than a deposition rate using the selected deposition gases at the deposition gas flow rates with a lower flow rate of the inert gas. As discussed above, nothing in the references suggests this feature.

Independent claim 57 and claims 58-59 depending therefrom are patentable because, for instance, the references do not teach or suggest that a ratio of the selected flow rate of He to the combined flow rate of SiH_4 and N_2O is at least 6.25:1 to deposit an antireflective layer on the substrate at a deposition rate which is lower than a deposition rate using the same flow rate of SiH_4 and the same flow rate of N_2O with a lower flow rate of He. This feature is completely absent from the cited references.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance and an action to that end is urged. If the Examiner believes a telephone conference would aid in the prosecution of this case in any way, please call the undersigned at 650-326-2400.

Respectfully submitted,

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